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USN | | | | | | | | | | EC762

Seventh Semester B.E. Degree Examination, May / June 08

Image Processing

Time: 3 hrs. Max. Marks: 1 00

Note: 1. *Answer any FIVE full questions.*
2. Assume missing data, if any, appropriately.

1 a. With the help of a neat block diagram, explain the components of a general purpose image processing system. (12 Marks)

b. Explain Microdensitometer type of image acquisition system. (08 Marks)

c. Explain any two methods used for digital image zooming and shrinking. (08 Marks)

2 d. Let p and q are the pixels at coordinates (10,12) and (15,20) respectively. Find out which distance measure gives the minimum distance between them. (06 Marks)

c. Explain the following: i) Aliasing and Moire patterns ii) Weber ratio iii) Illumination and reflectance model of the image. (06 Marks)

a. Give an expression for Discrete Cosine Transform and its inverse for a sequence f(x). Explain the properties. (08 Marks)

3 b. What are image transforms? List a few. (04 Marks)

c. Generate the Hadamard transform matrix H_n for n 2 from the core matrix

H 1 = r:: 1 (1 1) d' d0 ...;2 1 -1 an m 1cate Its'sequency. (08 Marks)

a. Explain in brief the following as applied to the Discrete Fourier Transform.

i) Convolution theorem
ii) Periodicity
iii) Conjugate symmetry and
iv) Separability (12 Marks)

4 b. Show that the Laplacian can be implemented in the frequency domain by using filter.

H(u, v) = -l(u - Ml2? + (v - N /2)2 J (08 Marks)

a. Explain image enhancement using Arithmetic and Logic operations. (08 Marks)

b. Why smoothing is needed in image processing and what is its effect on the image?

5 Explain an Ideal LPF and Butterworth LPF in the above context. (12 Marks)

a. With the help of neat graphical illustrations, explain the Power - law transformation and Piecewise linear contrast stretch. (10 Marks)

b. With the relevant p.d.f plots, explain: i) Gaussian noise, ii) Impulse noise. (06 Marks)

6 c. What are the applications of the second order derivative in image processing? (04 Marks)

a. Explain in brief the Inverse filtering approach and its limitation in image restoration. (04 Marks)

b. What is Order - statistics filter? Explain any two. Compare their relative merits and demerits. (08 Marks)

7 c. With the help of a block diagram, explain the Image Degradation and Restoration model and mention the reasons for degradation. (08 Marks)

8 a. Explain in brief, the properties of a Linear, Position invariant operator. (04 Marks)

b. Write a note on the RGB Colour model with neat sketches. (08 Marks)

c. Write a note on Intensity slicing as applied to pseudocolour image processing. (08 Marks)

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EC762

Seventh Semester B.E. Degree Examination, Dec. 07 / Jan. 08

Image Processing

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVEfull questions.*

1 a. With a neat block diagram, describe various components used in general purpose image processing system. (08 Marks)

b. Describe briefly the principle of image formation in the human eye. (06 Marks)

c. How the image acquisition is done using a single sensor. (06 Marks)

2. a. Explain the role of sampling and quantization in image processing system. (08 Marks) Define different types of adjacency and explain how m - adjacency in different from 8 - adjacency with an example. (06 Marks) Calculate the number of bits required to store a digital image of size 1 024x 1 024 pixels and the number of gray levels are 128. (06 Marks)

b.

c.

3 a. For the *2x2* transform A and the image U (07 Marks)

A = $\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$ and U = $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

Calculate the transformed image V and the basis images.

b. Give briefly any five properties of2 dimensional DFT. (05 Marks)

c. Construct Haar transform matrix ofN = 4. (08 Marks)

4 a. Give the expression for Hadamard transform and generate the corresponding 1 - D Kernel for N = 4. Explain any of its two properties. (12 Marks)

b. Highlight the useful expressions of discrete cosine transform and discuss its properties. (08 Marks)

5 a. Explain the basic concept of any two methods of piecewise linear transformation functions used in image enhancement. (06 Marks)

b.Develop a procedure to perform histogram matching. (08 Marks)

c. How the following spatial filters are important in image enhancement? Explain i) Smoothing filter ii) median filter. (06 Marks)

6 a. How are various filter masks are generated to sharpen images in spatial filter. (10 Marks)

b. With block diagram, analyze homomorphic filtering approach in the image enhancement. (10 Marks)

7 a. What are the important noise probability density functions are analyzed in the restoration process? Explain. (10 Marks)

b. Discuss various mean filters and order statistics filters in the image restoration system. (10 Marks)

8 a. Write short notes on: i) Weiner filtering and ii) Inverse filtering. (10 Marks)

b. Explain in detail Pseudo colour image processing. (10 Marks)

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NEW SCHEME

Seventh Semester B.E. Degree Examination, May 2007
EC/TC

Image Processing

Time: 3 hrs.] [Max. Marks: 1 00

Note: 1. *Answer any FIVEfull questions.*
2. Draw neat diagrams/waveforms wherever necessary.
3. Assume suitably for any missing data.

1 a. In connection with image processing system state:
i) Important application areas where image processing is essential.
ii) Components of an image processing system. (10 Marks)

b. What is image sampling and quantization? What are the different parameters which will decide the number of storage bits of the image in the discrete domain? (10 Marks)

2 a. What are the basic relationships between pixels? With neat diagrams and appropriate mathematical expressions explain:
i) Neighbours ii) Adjacency iii) Connectivity. (10 Marks)

b. For pixels p, q with co-ordinates (x, y) and (s, t) respectively find the distance metric D for the following cases: i) Euclidean distance De (p, q)
ii) City block distance D_4 (p, q) iii) Chessboard distance Dg (p, q). (05 Marks)

c. Find the time required in seconds for transmitting a monochrome binary image having size 2.5" X 2" scanned at 150 DPI to be sent at 28 kbps speed. (05 Marks)

3 a. Define Walsh transformation. Generate the corresponding 1 D kernel for N = 4. Find the transform W(u) for a given four point sequence f(x). Also find odd and even parts. (10 Marks)

b. With respect to 2D discrete Fourier Transform of an image explain the following, derive suitable equations:
i) Separability ii) Translation iii) Rotation iv) Periodicity. (10 Marks)

4 a. What are the different spatial domain techniques for image enhancement? (02 Marks)

b. Considering the basic gray level transformation of pixels, explain:
i) Contrast stretching ii) Gray level slicing iii) Bit plane slicing. (10 Marks)

c. Write an explanatory note on Histogram Equalization. (08 Marks)

5 a. What are the basic steps for image filtering in frequency domain? Explain with a block diagram. (10 Marks) Illustrate homomorphic filtering approach for image enhancement. Derive the suitable result. (10 Marks)

b.

6 a. What is the purpose of image restoration? Explain the model of image degradation and restoration process using suitable block diagram. (10 Marks) Explain how image degradation is carried out using:
i) Observation ii) Experiment iii) Mathematical modeling. (10 Marks) .

b.

7 a. With relevant mathematical expression, explain how a Wiener filter achieves restoration of a given degraded image. (10 Marks) What is geometric transformation? Explain how image restoration is achieved
through: i) Spatial Transformation ii) Gray level transformation. (10 Marks)

b.

8 a. Discuss briefly any two colour model used in colour image processing. (10 Marks)

b. Develop a scheme for converting colours from:
i) RGB to HSI ii) HSI to RGB. (10 Marks)

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EC762

USN

NEW SCHEMEl

Seventh Semester B.E. Degree Examination, Dec.06/Jan. ~07
EC/TC

Image Processing

Time: 3 hrs.] [Max. Marks: 100

Note:}. *Answer any FIVE full questions.*
2. Assume missing data if any appropriately for numerical questions.

1 a. With a neat block diagram, explain the fundamental steps in digital image processing. (07 Marks)

b. Explain the following term as applicable to image processing with necessary graphs.
i) Cones and Rods ii) Brightness adaptation iii) Isopreference (06 Marks)

c. Discuss the basic concepts of sampling and quantization by considering an example of a continuous image. (07 Marks)

2 a. Explain with necessary equations i) Adjacency ii) Distant measures which exhibits basic relationships between the pixels in an image. (06 Marks)

b. For a given orthogonal matrix A and image U

A~ JzC ~J U~ G ~J

Obtain i) Transformed image. ii) Original image from transformed image. (06 Marks)

c. Show that the variances of the transform coefficients can be written as a separable product i.e. (J~(K,l)=(J~(K)-(J;(1) (08 Marks)

3 a. Discuss in brief the properties of one - dimensional discrete Fourier transforms (DFT) / unitary discrete Fourier transforms (unitary DFT). (06 Marks)

b. Define the discrete cosine transform with relevant expressions and explain the properties of cosine transforms in brief. (08 Marks)

c. Given HI - the core matriy as H ı ~ JzC ~ 1], derive the expression for H3 assuming n = 3. Also indicate its sequency. (06 Marks)

4 a. Show that the average mean square error between the sequences u(n) and Zen) Jm is minimum when A = ~T; B = ~ ; AB = 1. for the following KL transform basin restriction (07 Marks)

Contd ....
2

b. With the help of graphical interpretation, explain some basic gray level transformations used for image enhancement. (07 Marks)

c. Explain the following terms with respect to image enhancement i) Contrast stretching ii) Gray -level slicing (06 Marks)

5 a. Explain the concept of Histogram matching, development of the method and the corresponding implementation with a suitable example. (06 Marks)

b. For a 3 x 3 mask, explain the mechanics of linear spatial filtering with necessary equations. (08 Marks)

c. Using the magnitude of the gradient, explain the use of first derivatives for image enhancement by taking a 3 x 3 region of image. (06 Marks)

6 a. With the help of a neat block diagram, explain the Homomorphic filtering approaching for image enhancement process. (10 Marks)

b. With necessary expressions, explain the periodic noise reduction by frequency domain filtering with respect to notch filter. (10 Mark.s)

7 a. Briefly explain the linear position invariant degradation employed for image restoration. (06 Marks)

b. Discuss the minimum mean square error (Wiener) filtering that incorporates both the degradation function and the statistical characteristics of noise into the restoration process. (08 Marks)

c. With respect to image restoration explain i) Spatial transformation ii) Gray level interpolation. (06 Marks)

8 a. With relevant probability density function, explain i) Raleigh Noise ii) Erlang (Gamma) Noise iii) Uniform Noise. (06 Marks)

b. Explain with necessary expression, the procedure for converting colours from RGB to HIS and vice versa. (06 Marks)

c. With a neat functional block diagram, explain the pseudo color image processing. Comment on pseudo color coding approaches. (08 Marks)

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e.

US

N NEW SCHEME

Seventh Semester B.E. Degree Examination, May / June 2006
EC/TC

Image Processing

Time: 3 hrs.] [Max. Marks:100

Note: 1. *Answer any FIVE questions.*

1 a. Explain with a neat block diagram all the components of a general purpose image processing system. Give an example for each of the component and explain how this system is different from other systems. (10 Marks)

b. What is the purpose of a color model? Explain the HSI color model with necessary figures. Write the equations for converting colors from RGB to HSI and vice versa. (10 Marks)

2 a. What is sampling and quantization? Explain spatial and gray level resolution. Indicate the effect of very low spatial and gray level resolution. (08 Marks)

b. Define a distance metric. Explain Euclidean, city block and chess board distance measures. For the following sub image, calculate each of the above distance measures. For v = {O,I} and 4 - connectivity, 8 - connectivity from point 'P' to 'Q'

	0	1	2	1	1 Q
	2	1	0	1	2
P	1	2	2	1	2

(12 Marks)

3 a. Prove the following properties of orthogonal unitary transforms:
i. Energy conservation and rotation.
ii. Energy compaction and variances
iii. Decorrelation (12 Marks)

b. For the 2 x 2 transform A and the image U calculate the transformed image V and the basis image. $A = \begin{bmatrix} 1 & 1 \\ 2 & -1 \end{bmatrix}$, $U = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$ (08 Marks)

4 a. Explain the significance of Karhunen Loeve transform and indicate how DCT is different from KL transform. (08 Marks)

b. Explain two-dimensional Ham- transform with its properties and obtain Haar transform matrix for N=8. - (12 Marks)

Contd 2

5 a. What is a histogram? Briefly explain the histogram equalization technique for image enhancement. (10 Marks)

b. An image has the gray level pdf per) shown in Figure-5(b I). It is desired to transform the gray levels of this image so that they will have the specified p(z) shown in Figure-5(b2). Assume continuous quantities and find the transformation in terms of r and z that will accomplish this.

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g.

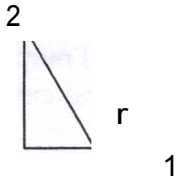

Figure-5(bl)

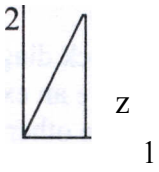

Figure-5(b2) (10 Marks)

6 a. What are convolution and correlation? Write and prove the convolution and correlation theorems in frequency domain. Mention the differences between these two operations with their applications. (12 Marks)

b. What is Homomorphic filtering? Explain the filtering approach with a block diagram. Indicate where this filtering is used and the effect of using this filter on images. (08 Marks)

7 a. Explain the model used for image degradation and restoration process and the different noise models. (08 Marks)

b. What is contraharmonic filtering? What is the advantage of this filter over other filters? Discuss the behavior of the filter in areas of constant gray levels for positive and negative Q. Discuss the behavior of the filter when Q = 0 and Q = -I. (12 Marks)

8 a. Explain inverse filtering and Wiener filtering for image restoration with necessary equations. (12 Marks)

b. Describe geometric transformations with necessary sketches and equations. (08 Marks)

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NEW SCHEME ~

EC762

h.

Reg. No.

Seventh Semester B.E. Degree Examination,

January IFebruary 2006 Electronics & Communication Engineering

Image Processing

Time: 3 hrs.) (Max. Marks : 100

Note: ***Answer any FIVE full questions.***

1. **(a)** With a neat block diagram, describe the fundamental steps in image processing. **(12 Marks)**

(b) Discuss the role of sampling and quantization processes with an example. **(8 Marks)**

2. **(a)** Develop a procedure to perform histogram matching. **(8 Marks)**

(b) Suppose that a digital image is subjected to histogram equalization. Show that a second pass of histogram equalization will produce exactly the same result as the first pass. **(8 Marks)**

(c) Develop a procedure for computing the median of an n x n neighborhood. **(4 Marks)**

3. **(a)** Prove the validity of $J[j(x,y) (\_l)x+y] = F(u - M/2, v - N/2)$ where $J[.]$ denotes the Fourier transform of the argument. **(10 Marks)**

(b) Suppose that you form a lowpass spatial filter that averages the four immediate neighbors of a point (x, y) but excludes the point itself.

i) Find the equivalent filter $H(u, v)$ in the frequency domain

ii) Show that your result is a lowpass filter. **(10 Marks)**

4. **(a)** With the block diagram of the degradation / restoration process, describe the different noise models. **(8 Marks)**

(b) Describe any four noise reduction spatial filters. **(12 Marks)**

5. **(a)** Discuss in brief any two color models. **(8 Marks)**

(b) Develop an algorithm which converts HSI color image to RGB color image. **(6 Marks)**

(c) Describe the histogram based processing in color images. **(6 Marks)**

6. **(a)** Construct Haar transform matrix of $N = 8$. **(8 Marks)**

(b) Show that the Cosine of transform of N elements can be calculated in $O(N \log N)$. **(6 Marks)**

(c) For the 2 x 2 transform A and the image U,

$$A = \frac{1}{2}\begin{bmatrix} \sqrt{3} & 1 \\ 1 & \sqrt{3} \end{bmatrix} \quad U = \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$$

Calculate the transformed image V and the basis images. **(6 Marks)**

Contd 2

7. **(a)** Describe the process of image acquisition using a single sensor. **(10 Marks)**

   (b) Explain how derivatives of images are implemented. Illustrate with a suitable example by considering Sobel operator. **(10 Marks)**

8. Write on the following :

(a) Properties of one dimensional DFT

(b) Wiener filtering technique

(c) Fast KL transform

(d) Histogram statistics for image enhancement **(5+5+5+5 Marks)**

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